

drift, and direction of overturned edges of shaly strata, and proved that it did not flow down the valleys to the westward, but passed across them and the ranges separating them, from the north to the south. On the other side of the Irish Sea the Rev. Mr. Close and others have shown that there also the ice did not move down the valleys, but flowed along the coast southwards. The ice-scratches still preserved on the rocks prove that the configuration of the land was nearly the same then as now, and no explanation has ever been offered of this southerly movement of the ice, excepting that it was prevented from flowing down the natural slope of the land by the whole of the Irish Sea having been at the time filled with ice up to a height of about 2,000 ft. above the present sea-level. The Isle of Man, that lay in the path of this great ice-stream, is glaciated from top to bottom, and it must have been completely buried in ice. It is to the action of this great agent that I ascribe the pushing up of sand and shells over south Lancashire, Cheshire, and North Wales on one side, and Wexford and around Dublin on the other, of the Irish Sea, where the course of the ice southward was obstructed by the narrowing of the channel.

So far from the movement of this great mass of ice being deflected or warded off by local glaciers, we have seen that in north Lancashire it was not affected by them; and long ago Prof. Ramsay proved that the glaciation of Anglesea and the west of Caernarvonshire had not radiated from the high land, but that the ice had come from the north and brought with it numerous boulders from the mountains of Cumberland.

As to the possibility of ice, pushed forward by higher accumulations behind it, thrusting before it loose sand and shells up to higher levels, I may remark that there are many proofs that it possesses this power. In the Isle of Man blocks of granite have been pushed up 600 feet above the level of their source. Mr. Tiddemann has also shown that as the ice moved across the valleys down one side and up the other, it thrust over the edges of the strata. On the other side of the great English watershed, Mr. Dakyns has shown that the ice when ascending the slope of a valley opposed to its course swept before it all the drift lying on the surface, pushing it over to the other side of the range.

Mr. Bonney would be more likely to damage my theory if, instead of protesting against it, he could explain some of the many difficulties that beset that of submergence. Where was the shore of that mythical sea under which England nearly to the Thames is supposed to have been submerged? How is it that not a single undisturbed bed of glacial shells has been found, that nearly all are broken to pieces, that many fragments of *Cyprina* exhibit glacial scratchings, and that not a single instance has been recorded of the two valves of a lamellibranch having been found together? Was there no friendly cliff or cavern able to preserve a single shell from the ruthless second advance of the ice? Mr. James Geikie finds the fragile bones of water-rats and frogs in his "inter-glacial beds," and uninjured land and fresh-water shells occur in abundance; but not one marine shell has been found in the uplands that does not show proof of having been transported, by being broken, worn, or scratched.

Since my first letter was sent to NATURE, Prof. Ramsay has drawn my attention to Mr. Croll's theory, that the glacial shells of Holderness had been pushed up by ice over the land out of the German Ocean. From other papers of the same geologist, I gather that he does not dispute the submergence of much of England and Scotland during part of the glacial period, and has indeed proposed a theory to account for it. So far as I know I stand alone at present in the opinion that neither during nor since the glacial epoch has there been any submergence of a great part of the British Isles beneath the waters of the ocean, nor can I expect that a theory so contrary to what has been taught for many years by English geologists will obtain a ready acceptance.

THOMAS BELT

Ealing, May 22

Uncompensated Chronometers

WITH reference to the employment of an uncompensated chronometer to indicate the mean temperature of an accompanying compensated chronometer during a long journey, with a view to the application of the proper correction for temperature, Prof. G. Forbes remarks (NATURE, vol. x. p. 50):—

"This method is quite new, and has not been tested by any nations except the Russians."

Permit me to direct attention to the following passage in the "Report on the Coast Survey," which I extract from p. 66 of

the Proceedings of the American Association for the Advancement of Science, Springfield meeting, August 1859. The "Cambridge" referred to is Cambridge, Massachusetts.

"The difference of longitude between Cambridge and Liverpool has also been determined by means of large numbers of chronometers carried repeatedly between the two stations on the Cunard steamships. These chronometric expeditions, in the words of Mr. W. C. Bond, director of the Harvard Observatory, 'for the magnitude and completeness of their equipments, have not been equalled by any of the similar undertakings of European Governments. Even the *Expedition chronometrique* of Struve was on a scale much less extensive.' The voyages were continued through a number of successive years. The first great special expedition took place in 1849, and the most recent in 1855. In the latter the effect of temperature on the rate of the chronometers formed a subject of special investigation. For each instrument the effect of temperature on its rate was ascertained by experiment, and the average temperature during each trip was kept account of by means of a thermometric chronometer, constructed like the others, but with individual balance, so that its daily rate was affected by six seconds for a change in temperature of 1° Fahr. Fifty-two chronometers were employed in this expedition, and were transported six times between Cambridge and Liverpool."

The "Greenwich Observations" for many years past (fifteen at least) contain a record of the indications of a "chronometrical thermometer" accompanying the chronometers on trial for purchase by the Admiralty; and on p. 2 of "Rates of Chronometers" in the volume of Observations for 1871 are these words:—

"The chronometrical thermometer differs from an ordinary chronometer only in the construction of the balance, the positions of the metals forming the compensating rims being reversed. By this arrangement the effect of temperature is much magnified."

J. D. EVERETT

Malone Road, Belfast, May 22

Photographic Irradiation

IN NATURE, vol. x. p. 29, the article on the coming Transit of Venus makes mention of photographic irradiation as having "been found by Lord Lindsay and Mr. A. C. Ranyard to be mainly due to the reflection of light from the back of the glass plate. It can be almost entirely avoided," Mr. Forbes goes on to say, "by wetting the back of the plate and placing black paper against it." This subject has been investigated, explained, and the above remedy suggested years ago by practical photographers. In 1867 I used the plates of the Liverpool Dry Plate Company, then sent out with the backs painted red to prevent irradiation.

But even this is not a complete preventive. Colouring the film, as suggested by Mr. Carey Lea of Philadelphia and Henry Cooper, a well-known English amateur, is a much more effectual means, though at a loss of sensitiveness; but the most complete (where the dry emulsion process is available) is to allow the collodion to be acted on by a large excess of nitrate of silver for a considerable time and then to convert this into bromide of silver by addition of ammonium bromide. The result is that the film has a dull opaque character like unglazed porcelain, and not only stops the light more completely than an ordinary collodion film, but remedies another cause of irradiation—the molecular reflection in the film itself.

Two years ago I tested plates prepared in this way on the most difficult subjects (not astronomical) and found the halation much less than by any other means except a deep red tint in the film.

W. J. STILLMAN

Hay Fever

REFERRING to the recent article in (NATURE, vol. x. p. 26) upon hay fever, I can give my own experience as having suffered from the complaint for some years past, mainly in the months of May and June. My most severe attacks have been in the house in early morning. I am, however, near hay-fields, and a tramp, by way of experiment, through one of these has more than once satisfied me of the efficacy of the hay pollen in vastly increasing the troublesome symptoms.

The treatment I have used to myself has consisted of rather strong doses of quinine taken internally, and externally a piece of linen rag dipped in strong camphorated spirit and placed upon the nose and also partly over the nostrils.

Inhaling the vapour of a piece of camphor inclosed in a small silver tube, and carried in the mouth like a cigar, has also, I know, been used with effect. I have judged that the attacks are, to a certain extent, connected with a depressed or relaxed state of the system, partly from the time (early morning) when I have found them at their worst, and partly from the fact that in a pure bracing air like Switzerland I do not get them, even in the haying season. A French lady with whom I once travelled by train tried to satisfy me I had only influenza (*la grippe*), but our passage through a hay-field soon brought on such a succession of sneezings, &c., that I was quickly accorded the honour of a distinct disease.

I tried the homœopathic remedy of extract of hay grasses in spirit, upon the advice of a friend, but I very soon came back again to my allopathic doses of quinine and camphorated spirit, and from these alone have I found any real benefit. I have not yet tried the solution of quinine applied to the nostrils.

Guildford, May 18

J. RAND CAPRON

THE STEAMSHIP "FARADAY" AND HER APPLIANCES FOR CABLE-LAYING*

THE lecturer in his introductory remarks observed that an electric telegraph consisted essentially of three parts, viz., the electro-motor or battery, the conductor, and the receiving instrument. He demonstrated experimentally that the conductor need not necessarily be metallic, but that water or rarefied air might be used as such within moderate limits; at the same time, for long submarine lines, insulated conductors strengthened by an outer sheathing were necessary to insure perfect transmission and immunity from accident. The first attempts at insulation, which consisted in the use of pitch and resinous matters, failed completely, and in the years 1846 and 1847 the two gums india-rubber and gutta-percha were introduced, the former by Prof. Jacobi of St. Petersburg, and the latter by Dr. Werner Siemens of Berlin; this last gum soon became almost indispensable to the cable manufacturer on account of its great plasticity and ductility.

The first outer sheathing used was a tube of lead drawn tightly over the insulated wire, and this again was covered with pieces of wrought-iron tubing connected by ball and socket joints; in this way the Messrs. Siemens successfully crossed various rivers. This method was superseded later on by the spiral-wire sheathing, first proposed by Mr. Bret in 1851 for the Dover and Calais cable; since then, with few modifications and exceptions, this form has been universally adopted.

The lecturer next enumerated the casualties to which submarine cables are liable, and the precautions employed to obviate them. He showed specimens destroyed by rust and the ravages of a species of *Teredo*. On the Indo-European line a curious case of fracture occurred; a whale, becoming entangled in a portion of cable overhanging a ledge of rock, broke it, and in striving to get free had so wound one end round its flukes that escape became hopeless, and so had fallen an easy prey to sharks, which had half devoured it when the grappling iron brought his remains to the surface. Other enemies to be dreaded are landslips, ships' anchors, and abrading currents.

The new Atlantic cable consists, for the deep-sea portion, of copper conductors, gutta-percha insulators, and a sheathing of steel wires covered with hemp; the shallow-water part consists of similar conductors and insulators sheathed with hemp, which in turn is covered with iron wire.

In paying out, the great point to be observed is that no catenary should be formed, but that the cable should be a straight line from the ship to the sea-bottom; the re-

taining force should be equal to the weight of a piece of cable hanging vertically downwards to the bottom of the sea. In picking up, a catenary is formed, but a vertical position is the best.

From the peculiar nature of the service for which a telegraph-ship is required, it is evident that she must possess properties somewhat different from those of ordinary ocean-going steamers; thus speed is not so important as great manœuvring powers, which will enable her to turn easily in a small space, or by which she may be maintained in a given position for a considerable time. In the ship about to be described an attempt has been made to meet these requirements.

The *Faraday*, of 5,000 tons register, was built at Newcastle by the eminent firm of Messrs. Mitchell & Co.; she is 360 ft. long, 52 ft. beam, and 36 ft. depth of hold; there are three large water-tight cable tanks having a capacity of 110,000 cubic ft., these are each 27 ft. deep, two are 45 ft. in diameter, and one is 37 ft., they can take in 1,700 miles of cable $1\frac{1}{2}$ in. in diameter. After the cable is coiled in, the tanks are filled up with water to keep it cool, for the lecturer had found, when conducting experiments on the Malta and Alexandria cable with his electrical resistance thermometer, that heat was spontaneously generated in the cable itself, whereby its insulation was seriously endangered.

The *Faraday* has stem and stern alike, and is fitted with a rudder at each end; both are worked by steam-steering apparatus placed amidships, and are capable of being rigidly fixed when required. She is propelled by a pair of cast steel screws 12 ft. in diameter, driven by a pair of compound engines constructed with a view to great economy of fuel. The two screws converge somewhat, and the effect of this arrangement is to enable the vessel to turn in her own length when the engines are worked in opposite directions. On the voyage from Newcastle to London a cask was thrown overboard, and from this as a centre the ship turned in her own length in 8 minutes 20 seconds, touching the cask three times during the operation. This manœuvring power is of great importance in such a case as repairing a fault in the cable, as it enables the engineer to keep her head in position, and, in short, to place her just where necessary in defiance of side-winds or currents.

The testing-room of the electrician in charge is amidships, and so placed as to command the two larger tanks, while the ship's speed can be at all times noted on the index of a Berthou hydrostatic log.

The deck is fitted with machinery to be used in laying operations, which will be best described by tracing the path of the cable from the tanks to the sea. Let us begin with the bow compartment: the cable, which lies coiled round one of Newall's cones, begins to be unwound, passes up through an eye carried on a beam placed across the hatch, next over a large pulley fitted with guides, and by a second pulley is gently made to follow a straight wooden trough fitted with friction rollers, which carries it aft to near the funnels; here it passes through the "jockey," which is a device for regulating the strain, consisting of a wheel riding on the cable, which can be adjusted by a lever, and a drum fitted with a brake, thence it passes on to a "compound paying-out and picking-up machine;" this consists of a large drum provided with a friction brake, and round it the cable passes three times; it is also furnished with a steam-engine, which by means of a clutch can be geared on to the drum when required. Now in paying out, the cable causes the drum to revolve as it runs over it, and the brakes regulate the speed as the vessel moves onward; but should a fault or other accident render it necessary to recover a portion, the drum is stopped and geared on to the engine, the ship's engines are reversed, the stern-rudder fixed; and so what was formerly the bow is now the stern, while the little engine hauls in the

* Abstract of a lecture delivered at the Royal Institution on May 15.—By C. William Siemens, D.C.L., F.R.S.